# Complete Summary

## GUIDELINE TITLE

Management of multidrug-resistant organisms in healthcare settings, 2006.

## BIBLIOGRAPHIC SOURCE(S)

Siegel JD, Rhinehart E, Jackson M, Chiarello L, Healthcare Infection Control Practices Advisory Committee. Management of multidrug-resistant organisms in healthcare settings. Atlanta (GA): Centers for Disease Control and Prevention; 2006. 74 p. [412 references]

## GUIDELINE STATUS

This is the current release of the guideline.

## COMPLETE SUMMARY CONTENT



## SCOPE

### DISEASE/CONDITION(S)

Infection with multidrug-resistant organisms including methicillin-resistant Staphylococcus aureus (MRSA), vancomycin-resistant enterococci (VRE) and certain gram negative bacilli (GNB)

### GUIDELINE CATEGORY

Management
Prevention

### CLINICAL SPECIALTY

Family Practice
Infectious Diseases
Internal Medicine
Preventive Medicine

## INTENDED USERS

Advanced Practice Nurses
Health Care Providers
Hospitals
Nurses
Physician Assistants
Physicians
Public Health Departments
Utilization Management

## GUIDELINE OBJECTIVE(S)

To guide the implementation of strategies and practices to prevent the transmission of methicillin-resistant Staphylococcus aureus, vancomycin-resistant enterococci, and other multidrug-resistant organisms

## TARGET POPULATION

Patients in healthcare facilities

## INTERVENTIONS AND PRACTICES CONSIDERED

1. General recommendations for all healthcare settings
    - Administrative measures
    - Education and training of healthcare personnel
    - Use of appropriate antimicrobial agents and regimens
    - Surveillance: microbiology laboratories, healthcare organizations, hospitals, long-term care facilities (LTCFs)
        - Facility-specific antimicrobial susceptibility reports
        - Monitoring of trends of multidrug-resistant organisms (MDROs)
    - Infection control precautions for prevention of transmission of MDROs
    - Use of contact precautions: acute care hospitals, LTCFs, ambulatory settings, home care settings, hemodialysis units
    - Environmental measures

2. Intensified interventions to prevent MDRO transmission
    - Indications and approach
    - Administrative measures
    - Educational interventions
    - Judicious use of antimicrobial agents
    - Surveillance: prevalence and incidence rates, active surveillance cultures, culture surveys
    - Enhanced infection control precautions: contact precautions
    - Implementation of policies for patients admission and placement to prevent transmission

- Enhanced environmental measures: disposable noncritical equipment, training of environmental staff, monitoring of cleaning performance, environmental cultures, environmental assessment and intensive cleaning
- Decolonization

### MAJOR OUTCOMES CONSIDERED

- Prevalence and incidence of targeted multidrug-resistant organisms (MDROs)
- Local susceptibility patterns
- Resistance patterns
- Transmission of MDRO
- Colonization of high-risk units

## METHODOLOGY

### METHODS USED TO COLLECT/SELECT EVIDENCE

Searches of Electronic Databases

### DESCRIPTION OF METHODS USED TO COLLECT/SELECT THE EVIDENCE

Not stated

### NUMBER OF SOURCE DOCUMENTS

Not stated

### METHODS USED TO ASSESS THE QUALITY AND STRENGTH OF THE EVIDENCE

Not stated

### RATING SCHEME FOR THE STRENGTH OF THE EVIDENCE

Not applicable

### METHODS USED TO ANALYZE THE EVIDENCE

Review

### DESCRIPTION OF THE METHODS USED TO ANALYZE THE EVIDENCE

Not stated

### METHODS USED TO FORMULATE THE RECOMMENDATIONS

Expert Consensus

## DESCRIPTION OF METHODS USED TO FORMULATE THE RECOMMENDATIONS

Not stated

## RATING SCHEME FOR THE STRENGTH OF THE RECOMMENDATIONS

### Recommendation Grades

Category IA Strongly recommended for implementation and strongly supported by well-designed experimental, clinical, or epidemiologic studies.

Category IB Strongly recommended for implementation and supported by some experimental, clinical, or epidemiologic studies and a strong theoretical rationale.

Category IC Required for implementation, as mandated by federal and/or state regulation or standard.

Category II Suggested for implementation and supported by suggestive clinical or epidemiologic studies or a theoretical rationale.

No recommendation Unresolved issue. Practices for which insufficient evidence or no consensus regarding efficacy exists.

## COST ANALYSIS

Several authors have provided evidence for the cost-effectiveness of approaches that use active surveillance cultures. However, the supportive evidence often relied on assumptions, projections, and estimated attributable costs of multidrug-resistant organism (MDRO) infections. Similar limitations apply to a study suggesting that gown use yields a cost benefit in controlling transmission of vancomycin-resistant enterococci in intensive care units. To date, no studies have directly compared the benefits and costs associated with different MDRO control strategies.

## METHOD OF GUIDELINE VALIDATION

Peer Review

## DESCRIPTION OF METHOD OF GUIDELINE VALIDATION

Not stated

# RECOMMENDATIONS

## MAJOR RECOMMENDATIONS

Definitions of the recommendation (Category IA, IB, IC, II) are provided at the end of the "Major Recommendations" field.

General Recommendations for All Healthcare Settings Independent of the Prevalence of Multidrug Resistant Organism (MDRO) Infections or the Population Served.

Administrative Measures

Make MDRO prevention and control an organizational patient safety priority. (Larson et al., 2000; Verhoef et al., 1999; Ostrowsky et al., 2001; Falk et al., 2000; Pittet et al., 2000; Calfee & Farr, 2002; Harbarth et al., "Effect," 2000; Curran, Benneyan, & Hood, 2002; Rampling et al., 2001; Wright et al., 2004; Montecalvo et al., 1999; Aubry-Damon et al., 1997; Cooper et al., 2004) Category IB

Provide administrative support, and both fiscal and human resources, to prevent and control MDRO transmission within the healthcare organization. (Larson et al., 2000; Ling et al., 2001; Verhoef et al., 1999; Haley et al., 1995; Pittet et al., 2000; Murray-Leisure et al., 1990; Jochimsen et al., 1999; Rampling et al., 2001; Cooper et al., 2004; Brown et al., 1998) Category IB

In healthcare facilities without expertise for analyzing epidemiologic data, recognizing MDRO problems, or devising effective control strategies (e.g., small or rural hospitals, rehabilitation centers, long-term care facilities [LTCFs], freestanding ambulatory centers), identify experts who can provide consultation as needed. (Ostrowsky et al., 2001; Nicolle et al., 1999) Category II

Implement systems to communicate information about reportable MDROs [e.g., vancomycin-resistant Staphylococcus aureus [VRSA], vancomycin-intermediate S. aureus [VISA], methicillin-resistant S. aureus [MRSA], Penicillin resistant Streptococcus pneumoniae (PRSP)] to administrative personnel and as required by state and local health authorities (www.cdc.gov/epo/dphsi/nndsshis.htm). Refer to websites for updated requirements of local and state health departments. Category II/IC

Implement a multidisciplinary process to monitor and improve healthcare personnel (HCP) adherence to recommended practices for Standard and Contact Precautions. (Larson et al., 2000; Puzniak et al., 2005; Pittet et al., 2000; Jochimsen et al., 1999; Lucet et al., 1999; Montecalvo et al., 1999; Slaughter et al., 1996; Eveillard et al., 2001; Cromer et al., 2004) Category IB

Implement systems to designate patients known to be colonized or infected with a targeted MDRO and to notify receiving healthcare facilities and personnel prior to transfer of such patients within or between facilities. (Ben-Ami et al., 2006; Ostrowsky et al., 2001) Category IB

Support participation of the facility or healthcare system in local, regional, and national coalitions to combat emerging or growing MDRO problems. ("The cost of antibiotic resistance," 2002; Verhoef, et al. 1999; Ostrowsky et al., 2001; Kotilainen et al., 2001; Nicolle et al., 1999; Gerber et al., 2006; Smith et al., 2004) Category IB

Provide updated feedback at least annually to healthcare providers and administrators on facility and patient-care-unit trends in MDRO infections. Include information on changes in prevalence or incidence of infection, results of assessments for system failures, and action plans to improve adherence to and effectiveness of recommended infection control practices to prevent MDRO transmission. (Haley et al., 1995; Falk et al., 2000; Hanna et al., 2001; Jochimsen et al., 1999; Nettleman et al., 1991; Curran, Benneyan, & Hood, 2002; Montecalvo et al., 1999; Eveillard et al., 2001; Assadian et al., 2002) Category IB

### Education and Training of Healthcare Personnel

Provide education and training on risks and prevention of MDRO transmission during orientation and periodic educational updates for healthcare personnel; include information on organizational experience with MDROs and prevention strategies. (Simor et al., 2002; Haley et al., 1995; Falk et al., 2000; Adeyemi-Doro et al., 1997; Villari et al., 2001; Lucet et al., 1999; D'Agata, Thayer, & Schaffner, 2000; Dubbert et al., 1990; Nettleman et al., 1991; Rupp et al., 2001; Montecalvo et al., 1999; Cromer et al., 2004; Byers et al., 1998; Patterson et al., 2000) Category IB

### Judicious Use of Antimicrobial Agents

The goal of the following recommendations is to ensure that systems are in place to promote optimal treatment of infections and appropriate antimicrobial use.

In hospitals and LTCFs, ensure that a multidisciplinary process is in place to review antimicrobial utilization, local susceptibility patterns (antibiograms), and antimicrobial agents included in the formulary to foster appropriate antimicrobial use. (Rice et al., 1996; Rahal et al., 1998; Meyer et al., 1993; Pena et al., 1998; Rupp et al., 2001; Montecalvo et al., 1999; Morris et al., 1995; Patterson et al., 2000; Bantar et al., 2003; Bisson et al., 2002; Carling et al., 2003; Quale et al., "Manipulation," 1996; Sample et al., 2002) Category IB

Implement systems (e.g., computerized physician order entry, comment in microbiology susceptibility report, notification from a clinical pharmacist or unit director) to prompt clinicians to use the appropriate antimicrobial agent and regimen for the given clinical situation. (Nourse et al., 2000; Rubin et al., 1992; Bartley et al., 2001; Carrier et al., 2002; van der Zwet et al., 1999; Macrae et al., 2001; Rahal et al., 1998; Meyer et al., 1993; Calil et al., 2001; Morris et al., 1995; Patterson et al., 2000; Bantar et al., 2003; Carling et al., 2003; Burke & Pestotnik, 1999; Cooper, Paull, & O'Reilly, 2002; Lagerlov et al., 2000; Lemmen et al., 2001; Liu et al., 2002; Monnet, 1998; Pestotnik et al., 1996) Category IB

Provide clinicians with antimicrobial susceptibility reports and analysis of current trends, updated at least annually, to guide antimicrobial prescribing practices. (Lagerlov et al., 2000) Category IB

In settings that administer antimicrobial agents but have limited electronic communication system infrastructures to implement physician prompts (e.g., LTCFs, home care, and infusion companies), implement a process for appropriate review of prescribed antimicrobials. Prepare and distribute reports to prescribers

that summarize findings and provide suggestions for improving antimicrobial use. (Lagerlov et al., 2000; Kupronis, Richards, & Whitney, 2003; Viray et al., 2005) Category II

Surveillance

In microbiology laboratories, use standardized laboratory methods and follow published guidance for determining antimicrobial susceptibility of targeted (e.g., MRSA, vancomycin-resistant enterococci [VRE], multi-drug resistant extended spectrum beta-lactamases [MDR-ESBLs]) and emerging (e.g., VRSA, MDR-Acinetobacter baumannii) MDROs. (Fierobe et al., 2001; Falk et al., 2000; Patterson et al., 2001; D'Agata, Thayer, & Schaffner, 2000; Byers et al., 2001; Rice et al., 1996; Morris et al, 1995; Chaitram et al., 2003; Ernst et al., 2004; Ginocchio, 2002; Stevenson et al., 2003) Category IB

In all healthcare organizations, establish systems to ensure that clinical microbiology laboratories (in-house and out-sourced) promptly notify infection control staff or a medical director/designee when a novel resistance pattern for that facility is detected. (Ling et al., 2001; CDC, "Staphylococcus," 2002; Falk et al., 2000; Christiansen et al., 2004; Embil et al., 2001) Category IB

In hospitals and LTCFs, develop and implement laboratory protocols for storing isolates of selected MDROs for molecular typing when needed to confirm transmission or delineate the epidemiology of the MDRO within the healthcare setting. (Fournier & Richet, 2006; Fierobe et al., 2001; Simor et al., 2002; Seybold et al., 2006; Jernigan et al., 1996; Falk et al., 2000; Boyce et al., 1995; D'Agata, Thayer, & Schaffner, 2000; Rampling et al., 2001; Rupp et al., 2001; Gupta et al., 2004; Rodriguez-Bano et al., 2006) Category IB

Prepare facility-specific antimicrobial susceptibility reports as recommended by the Clinical and Laboratory Standards Institute (CLSI) (www.phppo.cdc.gov/dls/master/default.aspx); monitor these reports for evidence of changing resistance patterns that may indicate the emergence or transmission of MDROs. (Ernst et al., 2004; Bhavnani et al., 2003; Halstead, Gomez, & McCarter, 2004) Category IB/IC

In hospitals and LTCFs with special-care units (e.g., ventilator-dependent, intensive care unit [ICU], or oncology units), develop and monitor unit-specific antimicrobial susceptibility reports. (Fridkin et al., 1999; Lang et al., 2001; White et al., 2000; Zoutman & Ford, 2005) Category IB

Establish a frequency for preparing summary reports based on volume of clinical isolates, with updates at least annually. Category II/IC

In healthcare organizations that outsource microbiology laboratory services (e.g., ambulatory care, home care, LTCFs, smaller acute care hospitals), specify by contract that the laboratory provide either facility-specific susceptibility data or local or regional aggregate susceptibility data in order to identify prevalent MDROs and trends in the geographic area served (Peterson et al., 2001) Category II

Monitor trends in the incidence of target MDROs in the facility over time using appropriate statistical methods to determine whether MDRO rates are decreasing and whether additional interventions are needed. (Haley et al, 1995; Falk et al., 2000; Murray-Leisure et al., 1990; Byers et al., 2001; Curran, Benneyan &, Hood, 2002; Rice et al., 1996; Rupp et al., 2001; Montecalvo et al., 1999; Simor, 2001; Benneyan, Lloyd, & Plsek, 2003; Gustafson, 2000; Calfee et al., 2003; Thompson, Cabezudo, & Wenzel, 1982) Category IA

Specify isolate origin (i.e., location and clinical service) in MDRO monitoring protocols in hospitals and other large multi-unit facilities with high-risk patients. (Fierobe et al., 2001; Simor et al., 2002; Haley et al., 1995; Jernigan et al, 1996; Falk et al., 2000; Rupp et al., 2001; Fridkin et al., 1999; Zoutman & Ford, 2005) Category IB

Establish a baseline (e.g., incidence) for targeted MDRO isolates by reviewing results of clinical cultures; if more timely or localized information is needed, perform baseline point prevalence studies of colonization in high-risk units. When possible, distinguish colonization from infection in analysis of these data. (Haley et al., 1995; Jernigan et al., 1996; Murray-Leisure et al, 1990; Jochimsen et al., 1999; Lucet et al., 1999; D'Agata, Thayer, & Schaffner, 2000; Byers et al., 2001; Curran, Benneyan, & Hood, 2002; Montecalvo et al., 1999; Thompson, Cabezudo, & Wenzel, 1982) Category IB

### Infection Control Precautions to Prevent Transmission of MDROs

Follow Standard Precautions during all patient encounters in all settings in which healthcare is delivered. (Evans et al., 2004; Webster, Faoagali, & Cartwright, 1994; Furuno et al., 2006; Warren et al., 2004; Trick et al, 2001) Category IB

Use masks according to Standard Precautions when performing splash-generating procedures (e.g., wound irrigation, oral suctioning, intubation); when caring for patients with open tracheostomies and the potential for projectile secretions; and in circumstances where there is evidence of transmission from heavily colonized sources (e.g., burn wounds). Masks are not otherwise recommended for prevention of MDRO transmission from patients to healthcare personnel during routine care (e.g., upon room entry). (Fierobe et al., 2001; CDC, 2002; Ostrowsky et al., 2001; Haley et al., 1995; Falk et al., 2000; Lucet et al., 1999; D'Agata, Thayer, & Schaffner, 2000; Byers et al., 2001; Rampling et al., 2001; Hartstein, LeMonte, & Iwamoto, 1997; Lacey et al., 2001) Category IB

### Use of Contact Precautions

In acute-care hospitals, implement Contact Precautions routinely for all patients infected with target MDROs and for patients that have been previously identified as being colonized with target MDROs (e.g., patients transferred from other units or facilities who are known to be colonized). (Urban, Segal-Maurer, & Rahal, 2003; Simor et al., 2002; Jernigan et al., 1995; Boyce, et al., "Outbreak," 1994; Ostrowsky et al, 2001; Murray-Leisure et al., 1990; Nicolle et al., 1999; Nettleman et al., 1991; Rupp et al., 2001; Montecalvo et al., 1999; Montesinos et al., 2003) Category IB

In LTCFs, consider the individual patient's clinical situation and prevalence or incidence of MDRO in the facility when deciding whether to implement or modify Contact Precautions in addition to Standard Precautions for a patient infected or colonized with a target MDRO. Category II

For relatively healthy residents (e.g., mainly independent) follow Standard Precautions, making sure that gloves and gowns are used for contact with uncontrolled secretions, pressure ulcers, draining wounds, stool incontinence, and ostomy tubes/bags. (Brennan, Wagener, & Muder, 1998; Strausbaugh et al., 1996; Bradley, 1999; Rahimi, 1998; Ostrowsky et al., 2001; Greenaway & Miller, 1999; Spindel, Strausbaugh, & Jacobson, 1995) Category II

For ill residents (e.g., those totally dependent upon healthcare personnel for healthcare and activities of daily living, ventilator-dependent) and for those residents whose infected secretions or drainage cannot be contained, use Contact Precautions in addition to Standard Precautions. (Trick et al., 2001; Bula et al., 2004; High et al., 2005) Category II

For MDRO colonized or infected patients without draining wounds, diarrhea, or uncontrolled secretions, establish ranges of permitted ambulation, socialization, and use of common areas based on their risk to other patients and on the ability of the colonized or infected patients to observe proper hand hygiene and other recommended precautions to contain secretions and excretions. (Ostrowsky et al., 2001; Armstrong-Evans et al., 1999; Silverblatt et al., 2000) Category II

In ambulatory settings, use Standard Precautions for patients known to be infected or colonized with target MDROs, making sure that gloves and gowns are used for contact with uncontrolled secretions, pressure ulcers, draining wounds, stool incontinence, and ostomy tubes and bags. Category II

In home care settings

- Follow Standard Precautions making sure to use gowns and gloves for contact with uncontrolled secretions, pressure ulcers, draining wounds, stool incontinence, and ostomy tubes and bags. Category II
- Limit the amount of reusable patient-care equipment that is brought into the home of patients infected or colonized with MDROs. When possible, leave patient-care equipment in the home until the patient is discharged from home care services. Category II
- If noncritical patient-care equipment (e.g., stethoscopes) cannot remain in the home, clean and disinfect items before removing them from the home, using a low to intermediate level disinfectant, or place reusable items in a plastic bag for transport to another site for subsequent cleaning and disinfection. Category II

No recommendation is made for routine use of gloves, gowns, or both to prevent MDRO transmission in ambulatory or home care settings. Unresolved issue

In hemodialysis units follow the "Recommendations to Prevent Transmission of Infections in Chronic Hemodialysis Patients" (2001) (www.cms.hhs.gov/home/regsguidance.asp). Category IC

Discontinuation of Contact Precautions

No recommendation can be made regarding when to discontinue Contact Precautions. Unresolved issue (See Background section of the original guideline document for discussion of options.)

Patient Placement in Hospitals and LTCFs

When single-patient rooms are available, assign priority for these rooms to patients with known or suspected MDRO colonization or infection. Give highest priority to those patients who have conditions that may facilitate transmission, e.g., uncontained secretions or excretions. (Fierobe et al., 2001; Simor et al., 2002; Boyce et al., 1997; Ostrowsky et al., 2001; Nicolle et al., 1999; Rampling et al., 2001; Hartstein, LeMonte, & Iwamoto, 1997; Montesinos et al., 2003) Category IB

When single-patient rooms are not available, cohort patients with the same MDRO in the same room or patient-care area. (Fierobe et al., 2001; Simor et al., 2002; Boyce, "Methicillin-resistant," 1994; Ostrowsky et al., 2001; Haley et al., 1995; Jernigan et al., 1996; Christiansen et al., 2004; Murray-Leisure et al., 1990; Jochimsen et al., 1999; Nicolle et al., 1999; Rupp et al., 2001; Montecalvo et al., 1999; Montesinos et al., 2003) Category IB

When cohorting patients with the same MDRO is not possible, place MDRO patients in rooms with patients who are at low risk for acquisition of MDROs and associated adverse outcomes from infection and are likely to have short lengths of stay. Category II

Environmental Measures

Clean and disinfect surfaces and equipment that may be contaminated with pathogens, including those that are in close proximity to the patient (e.g., bed rails, over bed tables) and frequently-touched surfaces in the patient care environment (e.g., door knobs, surfaces in and surrounding toilets in patients' rooms) on a more frequent schedule compared to that for minimal-touch surfaces (e.g., horizontal surfaces in waiting rooms). (Bhalla et al., 2004; Hota, 2004; Samore et al., 1996) Category IB

Dedicate noncritical medical items to use on individual patients known to be infected or colonized with MDROs. (Simor et al., 2002; Rupp et al., 2001; Brooks et al., 1998; Brooks et al., 1992; Jernigan et al., 1998) Category IB

Prioritize room cleaning of patients on Contact Precautions. Focus on cleaning and disinfecting frequently touched surfaces (e.g., bedrails, bedside commodes, bathroom fixtures in the patient's room, doorknobs) and equipment in the immediate vicinity of the patient. (Duckro et al., 2005; Boyce et al., 1997; Boyce et al., "Outbreak," 1994; Gerding et al., 1995; Donskey, 2004; Boyce, Havill, & Maria, 2005; Hota, 2004; Hayden et al., 2006; Samore et al., 1996; Chang & Nelson, 2000; Nicolle, 2000) Category IB

<u>Intensified Interventions to Prevent MDRO Transmission</u>

The interventions presented below have been utilized in various combinations to reduce transmission of MDROs in healthcare facilities. Neither the effectiveness of individual components nor that of specific combinations of control measures has been assessed in controlled trials. Nevertheless, various combinations of control elements selected under the guidance of knowledgeable content experts have repeatedly reduced MDRO transmission rates in a variety of healthcare settings.

## Indications and Approach

Indications for intensified MDRO control efforts (see below) should result in selection and implementation of one or more of the interventions described below. Individualize the selection of control measures according to local considerations. (Fierobe et al., 2002; Urban, Segal-Maurer, & Rahal, 2003; Simor et al., 2002; Jernigan et al., 1995; Boyce et al., "Outbreak," 1994; Haley et al., 1995; Jernigan et al., 1996; Falk et al., 2000; Murray-Leisure et al., 1990; Jochimsen et al., 1999; Calfee & Farr, 2002; Lucet et al., 1999; D'Agata, Thayer, & Schaffner, 2000; Byers et al., 2001; Harbarth et al., "Effect," 2000; Rice et al., 1996; Rupp et al., 2001; Montecalvo et al., 1999; Eveillard et al., 2001; Calfee et al., 2003; Thompson, Cabezudo, & Wenzel, 1982) Category IB

When incidence or prevalence of MDROs are not decreasing despite implementation of and correct adherence to the routine control measures described above, intensify MDRO control efforts by adopting one or more of the interventions described below. (Boyce et al., "Methicillin-resistant," 1994; Haley et al., 1995; Murray-Leisure et al., 1990; Jochimsen et al., 1999; Byers et al., 2001; Thompson, Cabezudo, & Wenzel, 1982) Category IB

When the first case or outbreak of an epidemiologically important MDRO (e.g., VRE, MRSA, VISA, VRSA, MDR-gram-negative bacilli [GNB]) is identified within a healthcare facility or unit. (CDC, "Staphylococcus," 2002; CDC, "Public Health Dispatch," 2002; Chang et al., 2003; Jernigan et al., 1995; Rao, Jacobs, & Joyce, 1988; Cohen, Morita, & Bradford, 1991; Jochimsen et al., 1999; Hartstein, LeMonte, & Iwamoto, 1997; Montecalvo et al., 1999; Bonten et al., 1998) Category IB

Continue to monitor the incidence of target MDRO infection and colonization after additional interventions are implemented. If rates do not decrease, implement more interventions as needed to reduce MDRO transmission. (Urban, Segal-Maurer, & Rahal, 2003; Simor et al., 2002; Jernigan et al., 1995; Boyce et al., "Methicillin-resistant," 1994; Haley et al., 1995; Macrae et al., 2001; Jochimsen et al., 1999; Thompson, Cabezudo & Wenzel, 1982) Category IB

## Administrative Measures

Identify persons with experience in infection control and the epidemiology of MDRO, either in house or through outside consultation, for assessment of the local MDRO problem and for the design, implementation, and evaluation of appropriate control measures. (Larson et al, 2000; Jernigan et al., 1995; Verhoef et al., 1999; Ostrowsky et al., 2001; Haley et al., 1995; Jernigan et al., 1996; Falk et al., 2000; Kotilainen et al., 2001; Jochimsen et al., 1999; D'Agata, Thayer, & Schaffner, 2000; Byers et al., 2001; Montecalvo et al., 1999; Cooper et al., 2004; Nicolle, 2000) Category IB

Provide necessary leadership, funding, and day-to-day oversight to implement interventions selected. Involve the governing body and leadership of the healthcare facility or system that have organizational responsibility for this and other infection control efforts. (Fierobe et al., 2001; Simor et al., 2002; Haley et al., 1995; Falk et al., 2000; Jochimsen et al., 1999 ; Lucet et al., 1999; D'Agata, Thayer, & Schaffner, 2000; Rampling et al., 2001) Category IB

Evaluate healthcare system factors for their role in creating or perpetuating transmission of MDROs, including: staffing levels, education and training, availability of consumable and durable resources, communication processes, policies and procedures, and adherence to recommended infection control measures (e.g., hand hygiene and Standard or Contact Precautions). Develop, implement, and monitor action plans to correct system failures.(Larson et al, 2000; Fierobe et al., 2001; Simor et al., 2002; Haley et al., 1995; Falk et al., 2000; Cohen, Morita, & Bradford, 1991; Adeyemi-Doro et al., 1997; Macrae et al., 2001; Nicolle et al., 1999; Arnow et al., 1982; Harbarth et al., 1999; Vicca, 1999; Rampling et al., 2001; Rupp et al., 2001; Ruchel et al., 1999; Brooks et al., 1998; Loeb et al., "Risk factors," 2003; McDonald, Banerjee, & Jarvis, 1998) Category IB

During the process, update healthcare providers and administrators on the progress and effectiveness of the intensified interventions. Include information on changes in prevalence, rates of infection and colonization; results of assessments and corrective actions for system failures; degrees of adherence to recommended practices; and action plans to improve adherence to recommended infection control practices to prevent MDRO transmission. (Haley et al., 1995; Falk et al., 2000; Hanna et al., 2001; Jochimsen et al., 1999; Nettleman et al., 1991; Curran, Benneyan, & Hood, 2002; Eveillard et al., 2001; Assadian et al., 2002; Montecalvo et al., 1995) Category IB

### Educational Interventions

Intensify the frequency of MDRO educational programs for healthcare personnel, especially those who work in areas in which MDRO rates are not decreasing. Provide individual or unit-specific feedback when available. (Larson et al., 2000; Simor et al., 2002; Haley et al., 1995; Falk et al., 2000; Hanna et al., 2001; Rao, Jacobs, & Joyce, 1988; Pittet et al., 2000; Murray-Leisure et al., 1990; Lucet et al., 1999; D'Agata, Thayer, & Schaffner, 2000; Byers et al., 2001; Harbarth et al., "Effect," 2000; Nettleman et al., 1991; Curran, Benneyan, & Hood, 2002; Rice et al., 1996; Pena et al., 1998; Calil et al., 2001; Eveillard et al., 2001) Category IB

### Judicious Use of Antimicrobial Agents

Review the role of antimicrobial use in perpetuating the MDRO problem targeted for intensified intervention. Control and improve antimicrobial use as indicated. Antimicrobial agents that may be targeted include vancomycin, third-generation cephalosporins, and anti-anaerobic agents for VRE (Rupp et al., 2001); third-generation cephalosporins for ESBLs (Rahal et al., 1998; Meyers et al, 1993; Pena et al., 1998); and quinolones and carbapenems. (Bradley, 1999; Nourse et al., 2000; Carrier et al., 2002; van der Zwet et al., 1999; Macrae et al., 2001; Rice et al., 1996; Calil et al., 2001; Montecalvo et al., 1999; Morris et al., 1995; Brown et

al., 1998; Patterson et al., 2000; Bantar et al., 2003; Carling et al., 2003; Cooper, Paull, & O'Reilly, 2002) Category IB

Surveillance

Calculate and analyze prevalence and incidence rates of targeted MDRO infection and colonization in populations at risk; when possible, distinguish colonization from infection. (Haley et al., 1995; Jernigan et al., 1996; Murray-Leisure et al., 1990; Jochimsen et al., 1999; Lucet et al., 1999; D'Agata, Thayer, & Schaffner, 2000; Byers et al., 2001; Curran, Benneyan, & Hood, 2002; Pena et al., 1998; Montecalvo et al., 1999; Thompson, Cabezudo, & Wenzel, 1982) Category IB

Include only one isolate per patient, not multiple isolates from the same patient, when calculating rates. (Shannon & French, 2002) Category II

Increase the frequency of compiling and monitoring antimicrobial susceptibility summary reports for a targeted MDRO as indicated by an increase in incidence of infection or colonization with that MDRO. Category II

Develop and implement protocols to obtain active surveillance cultures (ASC) for targeted MDROs from patients in populations at risk (e.g., patients in intensive care, burn, bone marrow/stem cell transplant, and oncology units; patients transferred from facilities known to have high MDRO prevalence rates; roommates of colonized or infected persons; and patients known to have been previously infected or colonized with an MDRO). (Fierobe et al., 2001; Simor et al., 2002; Jernigan et al., 1995; Boyce et al., "Outbreak," 1994; Ostrowsky et al., 2001; Haley et al., 1995; Jernigan et al., 1996; Falk et al., 2000; Kotilainen et al., 2001; Back et al., 1996; Murray-Leisure et al., 1990; Jochimsen et al., 1999; Boyce et al., 1995; Nicolle et al., 1999; Lucet et al., 1999; D'Agata, Thayer, & Schaffner, 2000; Siddiqui et al., 2002; Byers et al., 2001; Rupp et al., 2001; Montecalvo et al., 1999) Category IB

Obtain ASC from areas of skin breakdown and draining wounds. In addition, include the following sites according to target MDROs:

- For MRSA: Sampling the anterior nares is usually sufficient; throat, endotracheal tube aspirate, percutaneous gastrostomy sites, and perirectal or perineal cultures may be added to increase the yield. Swabs from several sites may be placed in the same selective broth tube prior to transport. (Boyce, Havill, & Maria, 2005; Singh et al., 2003; Grmek-Kosnik et al., 2005) Category IB
- For VRE: Stool, rectal, or perirectal samples should be collected. (Falk et al., 2000; Byers et al., 2001; Rupp et al., 2001; Montecalvo et al., 1999) Category IB
- For MDR-GNB: Endotracheal tube aspirates or sputum should be cultured if a respiratory tract reservoir is suspected, (e.g., Acinetobacterspp., Burkholderia spp.). (Villegas & Hartstein, 2003; Ramsey et al., 2001) Category IB

Obtain surveillance cultures for the target MDRO from patients at the time of admission to high-risk areas, e.g., ICUs, and at periodic intervals as needed to

assess MDRO transmission. (Fierobe et al., 2001; Ostrowsky et al., 2001; Falk et al., 2000; Hanna et al., 2001; Jochimsen et al., 1999; Rampling et al., 2001; Pena et al., 1998; Montecalvo et al., 1999; Harbarth et al., "Risk factors," 2000) Category IB

Conduct culture surveys to assess the efficacy of the enhanced MDRO control interventions.

Conduct serial (e.g., weekly, until transmission has ceased and then decreasing frequency) unit-specific point prevalence culture surveys of the target MDRO to determine if transmission has decreased or ceased. (Muto et al., 2003; Kotilainen et al., 2001; Macrae et al., 2001; Jochimsen et al., 1999; Nicolle et al., 1999; Calil et al., 2001; Sample et al., 2002) Category IB

Repeat point-prevalence culture surveys at routine intervals or at time of patient discharge or transfer until transmission has ceased. (Fierobe et al., 2001; Haley et al., 1995; Jernigan et al., 1996; Falk et al., 2000; Back et al., 1996; Buckholm et al., 2002; D'Agata, Thayer, & Schaffner, 2000; Pena et al., 1998; Calil et al. 2001; Montecalvo et al., 1999; Lucet et al., 1996) Category IB

If indicated by assessment of the MDRO problem, collect cultures to assess the colonization status of roommates and other patients with substantial exposure to patients with known MDRO infection or colonization. (Chang et al., 2003; Jernigan et al., 1995; Kotilainen et al., 2001; Byers et al., 2001) Category IB

Obtain cultures of healthcare personnel for target MDRO when there is epidemiologic evidence implicating the healthcare staff member as a source of ongoing transmission. (Jernigan et al., 1996; Thompson, Cabezudo, & Wenzel, 1982) Category IB

## Enhanced Infection Control Precautions

### Use of Contact Precautions

Implement Contact Precautions routinely for all patients colonized or infected with a target MDRO. (Fierobe et al, 2001; Urban, Segal-Maurer, & Rahal, 2003; Simor et al., 2002; Jernigan et al., 1995; Boyce et al., "Outbreak," 1994; Ostrowsky et al., 2001; Falk et al., 2000; Murray-Leisure et al., 1990; Nicolle et al., 1999; Lucet et al., 1999; Rupp et al., 2001; Montecalvo et al., 1999; Montesinos et al., 2003) Category IA

Because environmental surfaces and medical equipment, especially those in close proximity to the patient, may be contaminated, don gowns and gloves before or upon entry to the patient's room or cubicle. (Simor et al., 2002; Jernigan et al., 1995; Falk et al., 2000; Boyce et al., 1995; Lucet at al., 1999; Montecalvo et al., 1999) Category IB

In LTCFs, modify Contact Precautions to allow MDRO-colonized/infected patients whose site of colonization or infection can be appropriately contained and who can observe good hand hygiene practices to enter common areas and participate in

group activities. (Brennen, Wagener, & Muder, 1998; Trick et al., 2004; Ostrowsky et al., 2001; Greenaway & Miller, 1999) Category IB

When ASC are obtained as part of an intensified MDRO control program, implement Contact Precautions until the surveillance culture is reported negative for the target MDRO. (Fierobe et al, 2001; Srinivasan, Dick, & Perl, 2002; Jernigan et al., 1996; Malik et al., 1999; Stosor et al., 1999) Category IB

No recommendation is made regarding universal use of gloves, gowns, or both in high-risk units in acute-care hospitals. (Jernigan et al., 1996; Slaughter et al., 1996; Eveillard et al., 2001; Puzniak et al., 2004; Srinivasan et al., 2002) Unresolved issue

Implement policies for patient admission and placement as needed to prevent transmission of a problem MDRO. (Murray-Leisure et al., 1990; Jochimsen et al., 2002; Lucet at al., 1999; Byers et al., 2001; Montecalvo et al., 1999; Sample et al., 2002; Rumbak & Cancio, 1995) Category IB

Place MDRO patients in single-patient rooms. (Mahgoub, Ahmed, & Glatt, 2002; Ostrowsky et al., 2001; Karanfil et al., 1992; Dembry, Uzokwe, & Zervos, 1996; Carrier et al., 2002; Rao, Jacobs, & Joyce, 1988; Boyce et al., 1995; Rampling et al., 2001; Hartstein, LeMonte, & Iwamoto, 1997; Mulin et al., 1997; Quale et al., "Experience," 1996; Livornese et al., 1992; Gastmeier et al., 2004) Category IB

Cohort patients with the same MDRO in designated areas (e.g., rooms, bays, patient care areas. (Fierobe et al, 2001; Ostrowsky et al., 2001; Haley et al., 1995; Hanna et al., 2001; Bartley et al., 2001; Villari et al., 2001; Podnos et al., 2001; Murray-Leisure et al., 1990; Jochimsen et al., 1999; Nicolle et al., 1999; Rampling et al., 2001; Rupp et al., 2001; Montecalvo et al., 1999; Ruchel et al., 1999; Sample et al., 2002; Liu et al., 2002) Category IB

When transmission continues despite adherence to Standard and Contact Precautions and cohorting patients, assign dedicated nursing and ancillary service staff to the care of MDRO patients only. Some facilities may consider this option when intensified measures are first implemented. (Jochimsen et al., 1999; Rupp et al., 2001; Montecalvo et al., 1999; Austin et al., 1999) Category IB

Stop new admissions to the unit of facility if transmission continues despite the implementation of the enhanced control measures described above. (Refer to state or local regulations that may apply upon closure of hospital units or services.). (Ling et al., 2001; Simor et al., 2002; Verhoef et al., 1999; Hanna et al., 2001; Bartley et al., 2001; Back et al., 1996; Macrae et al., 2001; Curran, Benneyan & Hood, 2002; Law, Gill & Turner, 1988; Ruchel et al., 1999; Assadian et al., 2002; Sample et al., 2002; Ridwan et al., 2002) Category IB

Enhanced Environmental Measures

Implement patient-dedicated or single-use disposable noncritical equipment (e.g., blood pressure cuff, stethoscope) and instruments and devices. (Simor et al., 2002; Goetz et al., 1998; Ostrowsky et al., 2001; Nourse et al., 2000; Hanna et al., 2001; Armstrong-Evans et al., 1999; Podnos et al., 2001; Rupp et al., 2001;

Brooks et al., 1998; Brown et al., 1998; Greenaway & Miller, 1999; Malik et al., 1999; Stosor et al., 1999; Livornese et al., 1992) Category IB

Intensify and reinforce training of environmental staff who work in areas targeted for intensified MDRO control and monitor adherence to environmental cleaning policies. Some facilities may choose to assign dedicated staff to targeted patient care areas to enhance consistency of proper environmental cleaning and disinfection services. (Simor et al., 2002; Falk et al., 2000; Hanna et al., 2001; Zafar et al., 1995; Cohen, Morita, & Bradford, 1991; Adeyemi-Doro et al., 1997; Macrae et al., 2001; Bukholm et al., 2002; Roberts, Findlay, & Lang, 2001; Hollander et al., 2001; Podnos et al., 2001; Byers et al., 2001; Curran, Benneyan, & Hood, 2002; Rampling et al., 2001; Rupp et al., 2001; Law, Gill, & Turner, 1988; Hayden et al., 2006; Aubry-Damon et al., 1997; Sample et al., 2002; Hitomi et al., 2000) Category IB

Monitor (i.e., supervise and inspect) cleaning performance to ensure consistent cleaning and disinfection of surfaces in close proximity to the patient and those likely to be touched by the patient and HCP (e.g., bedrails, carts, bedside commodes, doorknobs, faucet handles). (Fierobe et al, 2001; Simor et al., 2002; Duckro et al., 2005; Bhalla et al., 2004; Falk et al., 2000; Embil et al., 2001; Hollander et al., 2001; Rampling et al., 2001; Rupp et al., 2001; Hayden et al., 2006; Byers et al., 1998; Weber & Rutala, 1997) Category IB

Obtain environmental cultures (e.g., surfaces, shared medical equipment) when there is epidemiologic evidence that an environmental source is associated with ongoing transmission of the targeted MDRO. (Schelenz & French, 2000; Kirschke et al., 2003; Srinivasan et al., 2003; Mangram & Jarvis, 1996) Category IB

Vacate units for environmental assessment and intensive cleaning when previous efforts to eliminate environmental reservoirs have failed. (Macrae et al., 2001; Curran, Benneyan, & Hood, 2002; Law, Gill, & Turner 1988; Sample et al., 2002; Vriens et al., 2002) Category II

Decolonization

Consult with physicians with expertise in infectious diseases and/or healthcare epidemiology on a case-by-case basis regarding the appropriate use of decolonization therapy for patients or staff during limited periods of time, as a component of an intensified MRSA control program. (Haley et al., 1995; Back et al., 1996; Rao, Jacobs, & Joyce, 1988; Cohen, Morita, & Bradford, 1991; Murray-Leisure et al., 1990; Harbarth et al., "Effect," 2000; Montesinos et al., 2003) Category II

When decolonization for MRSA is used, perform susceptibility testing for the decolonizing agent against the target organism in the individual being treated or the MDRO strain that is epidemiologically implicated in transmission. Monitor susceptibility to detect emergence of resistance to the decolonizing agent. Consult with a microbiologist for appropriate testing for mupirocin resistance, since standards have not been established. (Kauffman et al., 1993; Strausbaugh et al., 1992; Montesinos et al., 2003; Deshpande et al., 2002) Category IB

Because mupirocin-resistant strains may emerge and because it is unusual to eradicate MRSA when multiple body sites are colonized, do not use topical mupirocin routinely for MRSA decolonization of patients as a component of MRSA control programs in any healthcare setting. (Kauffman et al., 1993; Cederna et al., 1990) Category IB

Limit decolonization of HCP found to be colonized with MRSA to persons who have been epidemiologically linked as a likely source of ongoing transmission to patients. Consider reassignment of HCP if decolonization is not successful and ongoing transmission to patients persists. (Boyce et al., 1993; Faibis et al., 2005; Back et al., 1996) Category IB

No recommendation can be made for decolonizing patients with VRE or MDR-GNB. Regimens and efficacy of decolonization protocols for VRE and MDR-GNB have not been established. (Byers et al., 2002; Donskey et al., 2002; Scanvic et al., 2001; Loeb et al., "Antimicrobial drugs," 2003; Harbarth et al., "Risk factors," 2000; Hachem & Raad, 2002) Unresolved issue

Definitions:

Recommendation Grades

Category IA Strongly recommended for implementation and strongly supported by well-designed experimental, clinical, or epidemiologic studies.

Category IB Strongly recommended for implementation and supported by some experimental, clinical, or epidemiologic studies and a strong theoretical rationale.

Category IC Required for implementation, as mandated by federal and/or state regulation or standard.

Category II Suggested for implementation and supported by suggestive clinical or epidemiologic studies or a theoretical rationale.

No recommendation Unresolved issue. Practices for which insufficient evidence or no consensus regarding efficacy exists.

## CLINICAL ALGORITHM(S)

None provided

# EVIDENCE SUPPORTING THE RECOMMENDATIONS

## REFERENCES SUPPORTING THE RECOMMENDATIONS

References open in a new window

## TYPE OF EVIDENCE SUPPORTING THE RECOMMENDATIONS

The type of evidence is specifically stated for each recommendation.

## BENEFITS/HARMS OF IMPLEMENTING THE GUIDELINE RECOMMENDATIONS

### POTENTIAL BENEFITS

Appropriate prevention and control of multidrug-resistant organisms in the healthcare setting

### POTENTIAL HARMS

Not stated

## QUALIFYING STATEMENTS

### QUALIFYING STATEMENTS

This review demonstrates the depth of published science on the prevention and control of multidrug-resistant organisms (MDROs). Using a combination of interventions, MDROs in endemic, outbreak, and nonendemic settings have been brought under control. However, despite the volume of literature, an appropriate set of evidence-based control measures that can be universally applied in all healthcare settings has not been definitively established. This is due in part to differences in study methodology and outcome measures, including an absence of randomized, controlled trials comparing one MDRO control measure or strategy with another. Additionally, the data are largely descriptive and quasi-experimental in design. Few reports described preemptive efforts or prospective studies to control MDROs before they had reached high levels within a unit or facility. Furthermore, small hospitals and long-term care facilities (LTCFs) are infrequently represented in the literature. A number of questions remain and are discussed in section IV of the original guideline document.

## IMPLEMENTATION OF THE GUIDELINE

### DESCRIPTION OF IMPLEMENTATION STRATEGY

An implementation strategy was not provided.

## INSTITUTE OF MEDICINE (IOM) NATIONAL HEALTHCARE QUALITY REPORT CATEGORIES

### IOM CARE NEED

Staying Healthy

### IOM DOMAIN

Effectiveness
Safety

## IDENTIFYING INFORMATION AND AVAILABILITY

### BIBLIOGRAPHIC SOURCE(S)

Siegel JD, Rhinehart E, Jackson M, Chiarello L, Healthcare Infection Control Practices Advisory Committee. Management of multidrug-resistant organisms in healthcare settings. Atlanta (GA): Centers for Disease Control and Prevention; 2006. 74 p. [412 references]

### ADAPTATION

Not applicable: The guideline was not adapted from another source.

### DATE RELEASED

2006

### GUIDELINE DEVELOPER(S)

Centers for Disease Control and Prevention - Federal Government Agency [U.S.]

### SOURCE(S) OF FUNDING

United States Government

### GUIDELINE COMMITTEE

Healthcare Infection Control Practices Advisory Committee

### COMPOSITION OF GROUP THAT AUTHORED THE GUIDELINE

Primary Authors: Jane D. Siegel, MD; Emily Rhinehart, RN MPH CIC; Marguerite Jackson, PhD; Linda Chiarello, RN MS

Committee Members: Patrick J. Brennan, MD (Chair) Professor of Medicine, Division of Infectious Diseases, University of Pennsylvania Medical School; Michael Bell, MD (Executive Secretary) Division of Healthcare Quality Promotion, National Center for Infectious Diseases, Centers for Disease Control and Prevention; Vicki L. Brinsko, Infection Control Coordinator, Vanderbilt University Medical Center; E. Patchen Dellinger, MD, Professor of Surgery, University of Washington School of Medicine; Jeffrey Engel, MD, Head General Communicable Disease Control Branch, North Carolina State Epidemiologist; Steven M. Gordon, MD, Chairman, Department of Infectious Diseases, Hospital Epidemiologist, Cleveland Clinic Foundation, Department of Infectious Disease; Lizzie J. Harrell, PhD, D(ABMM), Research Professor of Molecular Genetics, Microbiology and Pathology, Associate Director, Clinical Microbiology, Duke University Medical Center; Carol O'Boyle, PhD, RN, Assistant Professor, School of Nursing, University of Minnesota; David Alexander Pegues, MD, Division of Infectious Diseases, David Geffen School of Medicine at UCLA; Dennis M. Perrotta, PhD., CIC, Adjunct Associate Professor of Epidemiology, University of Texas School of Public Health, Texas A&M University

School of Rural Public Health; Harriett M. Pitt, MS, CIC, RN, Director, Epidemiology, Long Beach Memorial Medical Center; Keith M. Ramsey, MD, Professor of Medicine, Medical Director of Infection Control, The Brody School of Medicine at East Carolina University; Nalini Singh, MD, Professor of Pediatrics, Epidemiology and International Health, The George Washington University Children's National Medical Center; Kurt Brown Stevenson, MD, MPH, Division of Infectious Diseases, Department of Internal Medicine, The Ohio State University Medical Center; Philip W. Smith, MD, Chief, Section of Infectious Diseases, Department of Internal Medicine, University of Nebraska Medical Center

### FINANCIAL DISCLOSURES/CONFLICTS OF INTEREST

Not stated

### GUIDELINE STATUS

This is the current release of the guideline.

### GUIDELINE AVAILABILITY

Electronic copies: Available in Portable Document Format (PDF) from the Centers for Disease Control and Prevention (CDC) Web site.

Print copies: Available from the Centers for Disease Control and Prevention, MMWR, Atlanta, GA 30333. Additional copies can be purchased from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402-9325; (202) 783-3238.

### AVAILABILITY OF COMPANION DOCUMENTS

None available

### PATIENT RESOURCES

None available

### NGC STATUS

This NGC summary was completed by ECRI Institute on May 29, 2007.

### COPYRIGHT STATEMENT



## DISCLAIMER

### NGC DISCLAIMER

All guidelines summarized by NGC and hosted on our site are produced under the auspices of medical specialty societies, relevant professional associations, public or private organizations, other government agencies, health care organizations or plans, and similar entities.

Guidelines represented on the NGC Web site are submitted by guideline developers, and are screened solely to determine that they meet the NGC Inclusion Criteria which may be found at http://www.guideline.gov/about/inclusion.aspx.

NGC, AHRQ, and its contractor ECRI make no warranties concerning the content or clinical efficacy or effectiveness of the clinical practice guidelines and related materials represented on this site. Moreover, the views and opinions of developers or authors of guidelines represented on this site do not necessarily state or reflect those of NGC, AHRQ, or its contractor ECRI, and inclusion or hosting of guidelines in NGC may not be used for advertising or commercial endorsement purposes.

Readers with questions regarding guideline content are directed to contact the guideline developer.



Date Modified: 10/15/2007